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(19) (CA) APPLICATION FOR CANADIAN PATENT (12)

(54) Procedure for the Production of Pulp

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(57) ABSTRACT OF DISCLOSURE

The invention relates to a procedure for the production of mechanical pulp from a fibrous product. To reduce the refining energy, the fibrous product is subjected to an enzyme treatment in which an enzyme acts on the hemicellulose and/or cellulose in the fibrous product. When hydrolytic enzymes are used, it is preferable to use oxidation-reduction ~~[illegible]~~ CHEMICALS to adjust the redox potential to the optimum level characteristic of each ~~[illegible]~~ enzyme. In addition to reducing the refining energy consumption, the enzyme treatment also improves the strength properties and the blue reflectance factor of the pulp.

HYDROLYTIC

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PROCEDURE FOR THE PRODUCTION OF PULP

The present invention relates to a procedure for the production of mechanical pulp from a fibrous product.

The production of mechanical pulp from a fibrous product, such as whole wood, wood chips, chips or refined pulp is mainly implemented by mechanical methods. The production of mechanical pulp is based on the utilization of friction. Energy is transferred to the wood in a compress-release process generating frictional heat which softens the wood so that individual fibres can be released.

Traditionally, mechanical pulp is produced either by grinding or refining. These methods have the disadvantage of a high energy consumption, but they also have the advantage of a high yield (about 95%). In the more advanced versions of the refining method, heat (TMP, thermomechanical pulp) and possibly also chemicals (CTMP) are used. Moreover, it has recently been established that the energy consumption in the defibration and refining of wood can be reduced by allowing white-rot fungi to act either on wood chips or on pulp produced by a single refining operation. However, this method has the disadvantage that the required reaction time is several days, even weeks. Besides, the reaction requires sterile conditions. These circumstances are an obstacle to large-scale and economical utilization of the method.

The object of the present invention is to create a solution that allows the refining energy requirement to be reduced from its present level. The invention is characterized in that the fibrous product is subjected to an enzyme treatment in which an enzyme acts on the hemicellulose and/or cellulose in the fibrous product. When the fibrous product is treated e.g. with the enzymes produced by the fungi

Aspergillus or Trichoderma (r), which act on cellulose and/or hemicelluose, in the presence of suitable oxidation-reduction chemicals or salts, a reduction in the refining energy is achieved even if a short reaction time is used, and no sterilization of the raw material is necessary.

In the procedure of the invention, the raw material subjected to enzyme treatment may be either whole wood, wood chips, or pulp refined one or more times. However, the enzyme action requires a good contact with as large a fibre area as possible.

The purpose of the enzyme treatment is to modify the structure of the hemicellulose and/or cellulose in the fibres in such a way that the fibres will come apart more easily during mechanical refining. The desired result is achieved by treating the fibrous product with a hydrolytic enzyme. The enzyme to be used is preferably hemicellulase, cellulase, esterase, pectinase or a mixture of these. Suitable enzymes are the xylanase, cellulase or pectinase produced by mold fungi or bacteria, e.g. Trichoderma (r). The temperature range of the enzyme treatment may be 10-90°C, preferably 40-70°C, and the pH range 2.0-10.0, preferably 4.0-8.0. Hydrolytic enzymes such as hemicellulase, cellulase, pectinase, esterase allow a large redox potential of the order of approx. -50 - 500 mV. However, it is preferable to adjust the redox potential using suitable oxidation-reduction chemicals, by means of which the lignin is so modified and resolved as to allow the hydrolytic enzymes to act on the hemicellulose and/or cellulose. Suitable chemicals thus used as redox regulators are e.g. ozone, hydrogen peroxide, chlorine dioxide and inorganic salts, used either by themselves or in mixtures.

In the following, the invention is described in detail by the aid of an embodiment example based on laboratory tests.

Example 1.

2000 g of once-refined TMP spruce wood pulp was elutriated in tap water so that the mixture obtained had a consistency of 2.9%. Hemicellulase was added to the mixture so that a mixture with a xylanase activity of 2 U/g of dry matter was obtained. The temperature of the mixture during the enzyme treatment was 20 °C and the treating time was 3 h.

After the enzyme treatment, sodium hydroxide (in an amount of 4% of the dry matter of the mixture) was added to the mixture. After 1 h 20 min, durig which time the mixture was not stirred, the mixture was concentrated, centrifugalized, homogenized and frozen.

The pulp was refined in a Sprout Waldron d 30 cm refiner with a diminishing blade distance. The refining was performed twice and the energy required for the refining each time was measured. After each refining run, a sample of 200 g (average) was taken. The samples were analyzed to determine the freeness value (CSF), fibre distribution, fibre length and shives content. In addition, a circulation water sheet was produced from each sample and analyzed to determine its density, tensile index, tear index, light scattering coefficient, light absorption coefficient and blue reflectance factor.

The analytical tests reflecting the refining result and the quality of the pulp are presented in Table 1.

In addition to the above-described test (test 2) illustrating the invention, a reference test (tests 1) was carried out. The results of this test are also presented in Table 1 and in Fig. 1, which shows the energy consumption E as a function of the freeness value CSF.

The reference test was performed as follows:

The pulp was not subjected to an enzyme treatment, but it was treated with tap water in conditions corresponding to those of the enzyme treatment in test 2. In all other respects, the treatment was performed as described above (test 2).

It can be seen from the results that the refining energy can be reduced if once-refined TMP pulp is subjected to an enzyme treatment as provided by the invention.

It can also be stated that the blue reflectance factor and certain strength properties of the enzyme-treated pulps were better than in the case of the control pulp.

It is obvious to a person skilled in the art that the invention is not restricted to the embodiment described above, but that it may instead be varied within the scope of the following claims.

TABLE 1

UNTREATED PULP		ENZYME-TREATED PULP	
Degree of refining (CSF)	Energy consumption (MJ/kg)	Degree of refining (CSF)	Energy consumption (MJ/kg)
400		400	
	3.12		1.95
315		335	
	1.95		2.07
225		230	
Total	5.07	Total	4.02

CLAIMS

1. Procedure for the production of mechanical pulp from a fibrous product, characterized in that the fibrous product is subjected to an enzyme treatment in which an enzyme acts on the hemicellulose and/or cellulose in the fibrous product.

2. Procedure according to claim 1, characterized in that a hydrolytic enzyme acts on the hemicellulose and/or cellulose in the fibrous product.

3. Procedure according to claim 1 or 2, characterized in that, when hydrolytic enzymes are used, the redox potential is adjusted by means of suitable oxidation-reduction chemicals.

4. Procedure according to any of the preceding claims, characterized in that the hydrolytic enzyme used is preferably hemicellulase, cellulase, esterase, pectinase or a mixture of these.

5. Procedure according to any of the preceding claims, characterized in that the oxidation chemical used with the hydrolytic enzyme is preferably hydrogen peroxide, ozone, chlorine dioxide, gaseous chlorine or oxygen, used either by themselves or in mixtures.

6. Procedure according to any of the preceding claims, characterised in that the reduction chemicals used with the hydrolytic enzyme are preferably gaseous nitrogen, sugars or sugar derivatives, organic acids or inorganic salts, used either by themselves or in mixtures.

7. Procedure according to any of the preceding claims, characterized in that the enzyme treatment

takes place within a temperature range of 10-90°C, preferably 40-75°C, and within a pH range of 2.0-10.0, preferably 4.0-8.0.

8. Use of enzymes acting on hemicellulose and/or cellulose to reduce the energy consumption in the production of mechanical pulp.

9. Use of an enzyme according to claim 8 to reduce the energy consumption in the production of mechanical pulp when ~~[illegible]~~ HYDROLYTIC enzymes are used.

10. Use of an enzyme according to claim 8 to reduce the energy consumption in the production of mechanical pulp when an oxidation-reduction chemical is used.

11. Use of an oxidizing chemical ACCORDING TO CLAIM 10 to reduce the energy consumption in the production of mechanical pulp, the oxidizing chemical being hydrogen peroxide, ozone, chlorine dioxide, gaséous chlorine or oxygen, used either by themselves or in mixtures.

12. Use of A reduction chemical~~s~~ according to claim ~~8~~ 10 to reduce the energy consumption in the production of mechanical pulp, the reduction chemicals being gaseous nitrogen or oxygen, antioxidants, sugars or sugar derivatives, organic acids or inorganic salts, used either by themselves or in mixtures.

13. Use of hemicellulase, cellulase, esterase, pectinase or mixtures of these according to claim 8-12 to reduce the energy consumption in the production of mechanical pulp.

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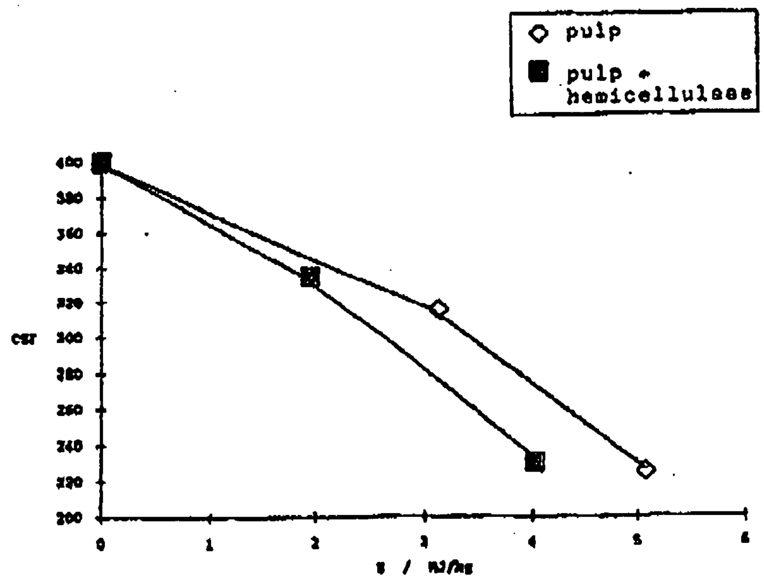

Fig. 1

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